

REMARKS

This Preliminary Amendment has been filed to make further amendments to the claims as amended in an Amendment dated September 17, 2009 which was filed with a Request for Continued Examination (RCE) as a response to the Office Action of March 17, 2009.

Claims 13-31 are pending in this application, and claims 13 and 31 are in independent form. Claims 13-30 are rejected under 35 U.S.C. § 103(a) for obviousness over United States Patent No. 5,289,867 to Barker et al. (hereinafter "the Barker patent") in view of United States Patent No. 5,770,832 to Carnes et al. (hereinafter "the Carnes patent"). Claim 13 is amended. Support for the amendment can be found in the specification at paragraphs [0028]-[0030] and [0046]. No new matter has been entered.

As defined by independent claim 13, the present invention is directed to a system for on-line prediction of mechanical property characteristics for hot rolled coils in a hot strip mill. The system includes a unit providing data on a rolling schedule in addition to chemistry regarding the product in the steel making stage. The system also includes field devices for obtaining real-time measuring parameters of the hot rolled coils during the rolling process. The data from the field devices is captured and converted using segment tracking from time domain data to space domain data by dividing a strip into segments and collecting process data comprising measured process parameters for each segment as it moves through the strip mill. The system further includes a computation module that processes all data and predicts mechanical properties of the hot rolled coils, the properties along the length and through the thickness of the strip being rolled. A display unit for displaying predicted values for each segment is further provided so preventive and corrective action can be taken during rolling, the values displayed being one or more of a cooling temperature, ferrite grain size, yield strength, ultimate tensile strength, percentage elongation, and nitrogen in solid solution/precipitate.

The Cited Prior Art

The Barker patent refers to a cooling system for use with a continuously rolled rod. The three-step process is ongoing and includes rod testing, comparison with historical data,

and determination of new set points. (See Barker patent, Col. 7, ll. 57-64) The process set points remain the same until new set points are entered to the controller. (See Barker patent, Col. 7, ll. 57-64) Set point information is given to a controller to obtain the desired physical properties of the rod. (See Barker patent, Col. 6, ll. 51-54) The set point is the nature of a valve position or fluid flow rate and the controller uses this information to set a motorized valve to obtain proper flow rate of fluid. (See Barker patent, Col. 6, ll. 59-66) The Barker patent further provides that the system has continuous information as to the position of the motorized valve and actual flow rate information. (See Barker patent, Col. 7, ll. 1-3) Therefore, the programmable logic controller is knowledgeable of the desired and actual flow rates and adjusts the flow rate to appropriately match the desired flow rate as previously determined by the set point. (See Barker patent, Col. 7, ll. 3-7)

After the production of a length of rod is completed, a sample of rod is tested to determine its physical properties. (See Barker patent, Col. 7, ll. 14-16) If the test determines the rod is out of tolerance, a computer will calculate, based on historical data, a new set point for the controller that is expected to bring the physical property into tolerance. (See Barker patent, Col. 7, ll. 25-30) The Barker patent describes a process where the controller can only change set points between production of rods when the testing, as previously discussed, determines a rod falls outside of a preset tolerance and a new set point is therefore needed and sent to the controller for the next rod production, whereby flow rates are adjusted according to the new set points. (See Barker patent, Col. 7, ll. 45-56)

None of the Prior Art Teaches or Suggests the System of Independent Claim 13

In the Office Action of March 17, 2009, the Examiner uses the Barker patent as the primary reference. The system of the Barker patent performs an ongoing three-step process, including: 1) rod testing; 2) comparison with historical data; and 3) determination of new set points. (See Barker patent, Col. 7, ll. 57-64) The system tests the rod and based on the physical property before starting (i.e., the temperature of the rod) the system will determine if new set points are needed, based on stored historical data and calculations run off-line. (See Barker patent, Col. 14, ll. 67-68 and Col. 7, ll. 31-32)

One of the novel and innovative concepts of the present invention is the segmentation tracking as set forth in independent claim 13, which has been amended in an effort to further prosecution and to describe that the strips operated on in the present invention are separated logically into discrete segments for tracking variability in the strip. Segmentation in the present invention is provided by dividing a total strip into a number of segments and collecting process data comprising measured process parameters for each segment as it moves through the strip mill. This segment tracking provides the means for converting time domain to space domain. Time domain is defined as the process related data collected by use of devices such as pyrometers, tachometers, and/or solenoid valves, among others, into space domain. Space domain is the operation of each of the time domain processes in terms of segmentation of the strip as it advances along the strip mill. Neither the Barker patent, nor any of the prior art, teaches or suggests a system that divides a strip into segments and collects process data comprising measured process parameters for each segment as it moves through the strip mill.

Another novel and innovative concept of the present invention is the display of information for segmentations that allows corrective and preventive action to be taken. This displayed information is shown for each of the segments as described above, giving cooling rate, volume fraction of aluminum nitride and properties such as yield strength, ultimate tensile strength, and percent elongation, not only along the length but also through the thickness at three different locations – center, surface, and quarter thickness.

Such an on-line prediction system helps the rolling mill operator take corrective action to get nearly uniform mechanical properties along the length of the strip. In addition the present invention as amended sets forth a display unit for displaying predicted values so preventive and corrective action can be taken during rolling, in contrast to the Barker patent which teaches away from such a system by using a three-step process whereby the system determines all settings prior to initiating the rod into the system. As stated previously, the Barker patent also describes performing calculations off-line during simulations on a computer with the results sent to a controller, but only in sequence between rods entering the system. (See the Barker patent, Col 14, ll. 67-68) The Barker patent does not teach or suggest having a display

for segments of a strip nor does it teach or suggest the display of values as the rod is rolling in the system. For the reasons stated hereinabove, Applicant believes that the subject matter of independent claim 13 is neither taught nor suggested by the Barker patent or the Carnes patent. Reconsideration of the rejection of claim 13 is therefore respectfully requested.

Claims 14-22 and 24-30 depend from and add further limitations to independent claim 13 and are believed to be allowable for the reasons discussed hereinabove in connection to independent claim 13. Reconsideration of the rejection of claims 14-22 and 24-30 is respectfully requested.

Conclusion

For the reasons set forth above, Applicant believes claims 14-22 and 24-31 are patentable over the cited art and are in condition for allowance. Reversal of all of the Examiner's rejections and allowance of these claims are respectfully requested.

Respectfully submitted,
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